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ABSTRACT

A study focused on the first phase of a longitudinal program of research designed to investigate the feasibility of constructing reading tests closely articulated with specific reading curricula and consistent with the current scientific understanding of reading processes. Participants, 298 beginning third-grade students, took two types of tests developed to investigate the importance of four factors that could influence student test performance: (1) the match between test words and words in the students' instructional program; (2) the emphasis of the students' instructional program; (3) the frequency of occurrence of each word; and (4) the decodability of each word. The tests were developed, first to investigate the importance of these factors in determining the validity of measures of decoding speed and accuracy, and next to investigate the importance of these factors on measures of speed and accuracy of recognizing word meaning. Words for both tests were presented to students using a specially prepared personal computer program. The results indicated a strong relationship between word frequency and the difficulty of the word, both for the decoding speed and accuracy test and the test of word recognition. (Eight tables of data are included; 27 references are attached; and six appendixes present data of Decoding Speed and Accuracy and Word Recognition Tests, the test administration computer program, and instructions to test administrators and students. (NH)

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Center for Research on Evaluation,
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RESEARCH ON INSTRUCTIONAL ASSESSMENT: INSTRUCTIONALLY RELEVANT READING ASSESSMENT

Speed and Accuracy of Word Decoding and Recognition

Project Director: Robert Linn

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Speed and Accuracy of Word Decoding and Recognition

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Considerable progress has been made in the scientific understanding of the reading process in the past decade (National Academy of Education, 1985). The advances that have been made have implications for the design of instructional materials and approaches to the teaching of reading (Pearson, 1986). They also have implications for testing and assessment. However, a comparison of the theory and experimental research on the reading process with current standardized reading tests suggests that there is a poor match between the two (Linn & Valencia, 1986a).

The focus of this report is on the first phase of a program of research designed to investigate the feasibility of constructing instructionally relevant reading tests that are closely articulated with specific reading curricula and that are consistent with the current scientific understanding of reading processes. The program of research is guided by a theoretical model proposed by Curtis and Glaser (1983). This model is based on an analysis of research on the cognitive processes involved in reading which suggests that there are four interdependent components of reading comprehension. These are (1) decoding speed and accuracy, (2) speed and accuracy of determining the semantic meaning of words, (3) passage dependent sentence comprehension, and (4) passage comprehension.

The focus of this report is on the first two components identified by Curtis and Glaser. Numerous studies have reaffirmed the importance of the ability to recognize words quickly and accurately (LaBerge & Samuels, 1974;

Stanovich, 1980; Lesgold & Perfetti, 1977; Perfetti & Lesgold, 1977). Additionally, there is evidecnce to suggest that accuracy of identification precedes automaticity and speed of word recognition (Adams & Huggins, 1985; Samuels & LaBerge, 1974; McCormick & Samuels, 1979). That is, speed of word recognition will be influenced by stage of acquisition or how familiar the student may be with each word. There is conflicting research however, with respect to the continued increase of speed of recognition and developmental trends in automaticity (Curtis, 1980; West & Stanovich, 1979; Perfetti & Hogaboam, 1975; Hogaboam & Perfetti, 1978). Some studies suggest that once a given level of automaticity is achieved, further increases in speed are unlikley. Other research points to continued increases in word recognition speed as reading achievement increases. West and Stanovich (1979) caution that one of the reasons some researchers have not been able to find developmental trends in automaticity is that many of the words used in these studies have been too easy.

The large body of research on the role of word recognition in skilled reading (see Linn & Valencia, 1986a for a review) illuminates the critical importance of word selection for tasks of speed and accuracy of decoding and recognition of word meaning. However, as summarized in our second progress report (Linn & Valencia, 1986b), our review of word recognition measures leads us to two conclusions: (1) speed of word recognition is only rarely measured directly and (2) the selection of words for tests is often more of an art than a science. There is seldom a clear justification for the inclusion of particular words on a test.

Given the wide-spread use of word recognition scores in the assessment of reading, these research-based conclusions raise serious questions about the use and interpretation of such scores. Not only are norm-referenced word recognition test scores used for evaluation, for screening, and as

indices of achievement but these results often are implicated in decisions for classroom instruction.

Our review of the research (Linn & Valencia, 1986a) suggests a number of factors that are potentially relevant in the selection of words for the measurement of speed and accuracy of word decoding or the measurement of speed and accuracy of the recognition of word meaning. Included among the potentially relevant factors are (1) word frequency, (2) inclusion and emphasis in the curriculum, (3) the approach of the instructioal program, (4) sound/symbol regularity (decodability), (5) orthographic regularity, (6) word type (content/function), and (7) word length (letters and syllables). Based on our review (Linn & Valencia, 1986a), however, we have concluded that the four factors that are most critical for creating specifications for a test of speed and accuracy of word identification are (1) word frequency, (2) curricular validity, (3) sound/symbol regularity, and (4) word length.

Word Frequency

Many studies have indicated that skilled readers are faster than less-skilled readers at identifying high frequency words both in isolation and in context (Biemiller, 1977-78; Curtis, 1980; Perfetti, Finger & Hogaboam, 1978; Juel, 1980; Perfetti & Hogaboam, 1978; West & Stanovich, 1979). This suggests that the more interactions and exposures students have with words, the faster they are likely to correctly identify them. At the same time, however, Perfetti and Hogaboam (1975) and Juel (1980) have demonstrated that differences between good readers and poor readers are even greater for low frequency and pseudo words than for high frequency words. This work suggests that speed is not simply a function of familiarity with particular

words but that good readers possess the skills to quickly identify less frequent, or unknown words.

Curricular Validity

Related to the issue of frequency, is exposure to words in terms of curricular validity. Juel and Roper-Schneider (1985), for example, found that repeated exposures to words, the number of repetions in the basal, was a significant factor in accuracy of basal word identification. These findings suggest that the match between the words on a test and those in the textbooks and instructional program materials may be an important determinate of the instructional validity of a test. In many cases, the relative frequency of words in a curricular program corresponds to a more global index of frequency (i.e. Carroll, Davies & Richman, 1971) but in other cases, curricular exposure may enhance or detract from students' exposure to particular words. That is, a specific instructional program may include many repetitions of selected words but restrict or limit the inclusion of others. This research also suggests that increased reading in a variety of material may provide added exposure to words that may in turn increase word identification speed and accuracy.

Sound-Symbol Regularity

Although some degree of sound-symbol regularity is likely to coincide with indices of word frequency, it is more likely that word identification is mediated by the recognition of certain letter patterns (Venezky & Massaro, 1979). Recent work of Gough, Juel, & Roper/Schneider (1983) found that children with strong decoding skills pronounced, or mispronounced, words independent of the number of times they had seen the word in their school reading material while less skilled decoders only correctly pronounced words they had seen frequently in their basal textbooks. Other studies (Juel, 1980) have indicated that words classified as difficult to

decode cause more errors than any other words regardless of context and frequency. These words also present more difficulty for low ability students than for more able students.

Word Length/Syllables

It is clear that word length and number of syllables are factors in the speed of word identification. Perfetti, Finger & Hogaboam (1978) and Hogaboam & Perfetti (1978) demonstrated that students pronounce one syllable words more quickly than two syllable words and that less skilled readers are more affected by the number of syllables and length of word than their more skilled counterparts. Not only may longer, multisyllabic words take more time to recognize but they obviously require more time to pronounce.

Purpose and Hypotheses

The purpose of this study was to determine the effects of various word and curricular factors on direct measures of decoding speed and accuracy and the speed and accuracy of word recognition. In general, it was hypothesized that the following factors would influence student performance on the two tests: (1) the match betwen test words and the words in the students' instructional program; (2) the emphasis of the students' instuctional program; (3) the frequency of occurrence of each word; (4) the amount of reading engaged in by each student; and (5) the decodability of each word.

Method

Subjects

A total of 298 beginning third grade students in three school districts in Illinois participated in the study. The three school districts have been participants in a longitudinal study of instructional

practices and student achievement (Meyer, Linn, & Hastings, 1985). The three districts vary considerably in terms of demographics and instructional programs. District A, where 76 of the students included in the present study attend school, is located in a small town in the central part of the state. The district has a stable and relatively homogeneous student population that is characteristic of farming communities in central Illinois. District B is also in a small town, but one that is more of a middle and upper-middle class "bedroom" community. Many of the 147 participating students' parents commute a short distance to a nearby larger town where they work. District C is a separately incorporated city in the Chicago area. The 75 participating students in District C come from a variety of socioeconomic backgrounds (see, Meyer, Linn, Mayberry,& Hastings, 1985, for a more complete description). Despite the differences in communities and student backgrounds, the students in the three districts had very similar distributions of scores on the Wide Range Achievement Test (WRAT) when they entered kindergarten. In the fall of 1983 the beginning kindergarten means and standard deviations on the WRAT were 19.3 and 7.69 for district A, 19.1 and 6.82 for district B, and 18.6 and 7.83 for district C (Linn and Meyer, 1985).

As documented by Meyer, Linn, and Hastings (1985), the three districts differ substantially in their instructional programs. Of particular relevance to the present study is the fact that the three districts use three different basal series. The Ginn, the Harcourt Brace Jovanovich, and the Houghton Mifflin basal series were used in districts A, B, and C respectively prior to the beginning of third grade.

Test Construction

Two types of tests were developed to investigate the importance of the above factors in determining the validity of measures of decoding speed and

accuracy and measures of speed and accuracy of recognizing word meaning. Detailed specifications of the two tests are presented below.

Decoding Speed and Accuracy. The decoding speed and accuracy test consisted of several lists of words which students read aloud to a trained examiner. To construct the lists, all words in each kindergarten, grade 1, and grade 2 book of each reading series were tabulated to determine the frequency of occurrence. Table 1 lists the number of words and the number of unique words found in the books by publisher and grade. Also shown are publisher subtotals for kindergarten, grade 1, and grade 2 combined. Total words and unique words correspond to what Carroll, Davies, and Richman (1981) have referred to as "tokens" and "types", respectively.

As can be seen, there is substantial variability in the size of vocabulary introduced by the three basal series. The Harcourt-Brace-Jovanovich series of books used in kindergarten through grade 2 has only about two-thirds as many distinct words (i.e., types) as the Ginn series. The overlap of vocabulary between publishers can be seen by breaking down the total of 4984 unique words found in the combined set of three publishers over the three grade levels. Only 710 of the 4,984 words are common to all three publishers. Another 503 words are common to the Ginn and Houghton Mifflin series, 305 to the Ginn and Harcourt Brace Jovanovich series, and 239 to the Houghton Mifflin and Harcourt Brace Jovanovich series. This leaves a total of 3,227 words that occur in only one of the three series. Harcourt Brace Jovanovich has the fewest words (617) that are not shared with either of the other two series. The corresponding numbers for Ginn and Houghton Mifflin are 1,329 and 1,281, respectively. This suggests that the Harcourt-Brace-Javanovich series used a more rigorously controlled vocabulary than the other two series.

Table 1

Word Frequencies for Basal Readers by Grade

Publisher	Grade	Total Words (Tokens)	Unique Words (Types)
Ginn	K	3,102	157
Ginn	1	17,857	1,120
Ginn	2	39,865	2,443
Ginn	K, 1, & 2	60,824	2,847
Harcourt Brace Jovanovich	K	4,141	156
Harcourt Brace Jovanovich	1	13,690	677
Harcourt Brace Jovanovich	2	31,429	1,619
Harcourt Brace Jovanovich	K, 1, & 2	49,260	1,871
Houghton Mifflin	K	5,619	220
Houghton Mifflin	1	19,907	1,100
Houghton Mifflin	2	38,400	2,342
Houghton Mifflin	K, 1, & 2	63,926	2,733
Ginn, HBJ, & HM	K	12,862	378
Ginn, HBJ, & HM	1	51,454	1,880
Ginn, HBJ, & HM	2	109,694	4,398
Ginn, HBJ, & HM	K, 1, & 2	174,010	4,984

Individual word frequencies were collapsed within grade level to produce a kindergarten, grade 1, and grade 2 word list for each reading series. From this curricular word frequency document 8 word lists were constructed:

List 1: Words shared by all three series in grade 1 and grade 2. These words represented the "easy" high frequency words with a Standard Frequency Index (Carroll, Davies, & Richman, 1971) of 63.9 to 73.6 (mean = 69.7). The Standard Frequency Index, or SFI, is on a log scale. A word with an SFI of 70 is estimated to occur once in every 1,000 words of text of the type analyzed by Carroll, et al. Changes in the SFI of 10 correspond to factors of 10 in the number of words. Thus, SFI values of 40, 50 and 60, for example, correspond to 1 occurrence in 1,000,000, 1 in 100,000, and 1 in 10,000, respectively.

Each word in list 1 occurred a minimum of 10 times in each series and the difference across series never exceeded a 2 to 1 ratio. These criteria were imposed to assure that students had more than passing exposure to the selected words and the differential exposure across reading series was held to a minimum. For example, two of the words from list 1 were "never" and "call". The SFI's and the frequency of occurrence by grade and publisher for these two words were as follows:

			Publisher Frequency		
Word	SFI	Grade	Ginn	HBJ	HM
never	67.5	1	10	12	11
		2	41	35	41
call	63.9	1	42	41	30
		2	55	49	61

A complete listing of the words in all lists can be found in Appendix A. The first 10 words in Appendix A belong to list 1.

List 2: Words shared by all series in grade 2 only. These words represented the somewhat more difficult, lower-frequency words for this sample of students with SFI's ranging from 55.0 to 66.4 (mean = 60.9). Each word occurred a minimum of 4 times in the grade 2 books for each publisher. Words of high and low text frequency were balanced across the three series so that each series contributed words of high and low frequency words for that particular series. In this way, no single series contributed a greater number of more frequently occurring words than another series. Words 10 thru 20 in Appendix A belong to list 2. The average frequency with which a list 2 word occurred in grade 2 books was 10.1 for Ginn, 10.9 for Harcourt Brace Jovanovich, and 10.7 for Houghton-Mifflin (Apppendix A).

Lists 3 through 5: Each of these lists contained words included in one reading series but not in the other two. These words represented unique, relatively easy words in each series. The mean, median, minimum, and maximum Carroll, Davies, and Richman SFI's are listed in Table 2 for each of lists 3 through 5. Also listed are the mean, median, minimum, and maximum frequency of occurrence for the ten words in the grade two books for each publisher. While the match in frequency and SFI for these three publisher specific lists is not perfect, the lists are quite comparable in terms of these two characteristics.

Lists 6 through 8. Each of these lists also consisted of words unique to a single series but were more difficult than those in lists 3 through 5. Table 2 also provides a comparison of these lists in terms of SFI's and frequency of occurrence in each series. With a mean SFI of about 50, the average word in these lists would be expected to occur once per 100,000 words of text.

Table 2

Mean, Median, Minimum, and Maximum SFI and

Grade 2 Frequency of Occurrence by Word List/Series

		SFI				Grade 2 Frequency			
List	Publisher	Mean	Median	Min.	Max.	Mean	Median	Min.	Max.
3	Ginn	58.0	57.2	55.7	61.1	11.2	10.0	5	27
4	HBJ	57.0	57.1	54.4	60.2	10.6	8.0	5	30
5	HM	59.1	59.5	53.3	61.6	8.9	7.7	5	15
6	Ginn	50.4	51.4	46.0	54.8	9.9	9.0	5	20
7	HBJ	49.0	49.0	45.2	53.9	8.5	9.0	5	19
8	HM	50.7	51.7	47.5	54.1	9.6	7.0	5	21
9	General	58.5	58.6	56.5	60.1	0	0	0	0
10	General	50.6	51.0	47.4	52.3	0	0	0	0

Lists 9 and 10. In addition to the 8 lists of 10 words each that were constructed from the basal word frequency analyses, two additional lists of 10 words each were constructed. The final two lists were comprised of words that were not included in any of the kindergarten, first, or second grade reading series used in the three schools. That is, lists 9 and 10 contained only words that students had not encountered in their reading books at school. Words in list 9 corresponded in length, number of syllables, and SFI to the basal words in lists 3 through 5 (see Table 2 for SFI summary statistics). List 10 words paralleled those basal words in lists 6 through 8. Thus, the list 10 words represented the relatively more difficult words outside of students' basal reading exposure.

Word Length/Syllables. As alluded to above, these factors were controlled in two ways. First, words on contrasting lists (i.e., lists 3, 4, 5, and 9; lists 6, 7, 8, and 10--equivalent frequency words within and outside the instructional program) were matched for number of letters (plus or minus one letter). Second, words were matched for number of syllables. Matching on both these variables insured that differences in speed of vocalization could not be attributed simply to word length.

Decodability. Based on Venezky's (1967; 1970) research on the sound/symbol regularity of words in spelling and reading, all test words were classified into one of three levels of predictability. Level 1 words are those whose patterns would be predicted on the basis of regular graphemic, morphemic, or phonemic features (e.g., cat, twenty, made, coffee). These words could be labeled "easily" decodable. They corresponded to cvc and cvcv patterns, contained primary long and short vowels, unambiguous consonants, or invariant consonant blends. In other

words, if you apply the most common phonics "rules" here, they lead to accurate word identification.

Level 2 words are less predictable than level 1 words, representing patterns that have several possible and probable pronunciation alternatives. These alternatives, however, are sufficiently frequent to permit the application of some generalizations. That is, these alternatives occur frequently enough so that the use of an association letter group or family could be profitably employed in teaching (Venezky, 1970). These words often contained consonant diagraphs and vowel diagraphs and could be correctly decoded by trying several probable pronunciations of a given pattern (e.g., thread, sight, narrow). They require more complex concepts and analyses than Level 1 words. The "rules" often don't guide the correct pronunciation of these words, but knowing the possible patterns probably does help.

Level 3 contained words with patterns that did not conform to any probable or predictable pronunciations (e.g., idea, above, science). These words could be labeled irregular words or sight words. Strong decoding skills would not necessarily help here, though increased exposure, perhaps through wide reading, might be beneficial. The decodability level of each word is indicated in Appendix A under the column heading "D".

Speed and Accuracy of Recognition of Word Meaning. The second test was designed to measure a student's knowledge of word meanings. The test was patterned after work by Anderson and Freebody (1983), but differed in terms of the criteria used for the selection of words, the age level of the students, and the mode of administration. It also included a measure of speed as well as accuracy.

Anderson and Freebody (1983) have demonstrated that very good measures of a fifth grade students' word knowledge can be obtained quite efficiently

by presenting a list of words interspersed with nonwords or pseudo words and simply asking students whether the string of letters is or is not a word. After administering a multiple choice vocabulary test, a yes/no test and then interviewing students on the meanings of these words, Anderson & Freebody concluded that "a person's score on a yes/no vocabulary test, suitably adjusted to discount any tendency to overestimate vocabulary knowledge, is an excellent indicator of the number of words this person truly knows" (Anderson & Freebody, 1981, p.14). As reviewed previously (Linn & Valencia, 1986b), this procedure may be useful to distinguish accuracy and fluency of semantic word meanings (Curtis & Glaser, 1983). This yes/no vocabulary measure was investigated in the present study with the sample of beginning third grade students.

The test consisted of 100 items, half of which were real words. The real words were classified into 6 lists. List 1 consisted of 5 "easy" words that occurred in all three basal series. The average SFI for these words is 62.6. Lists 2 through 4 consisted of 5-7 words that occurred between 4 and 9 times in one and only one of the series. The mean SFI for the three lists was 52.6 for the 6 words from Ginn, 51.2 for the 7 words from Houghton-Mifflin, and 50.7 for the 5 words from Harcourt Brace Jovanovich. List 5 consisted of 6 words that were approximately matched in terms of SFI (mean = 54.6), word length, and predictability with those in lists 2 through 4, but which did not occur more than once in any of the three series. The last list of words consisted of 21 words not found in any of the three series and which had SFI's ranging from 31.3 to 45.0, with a mean of 39.6. Thus, list 6 contained words that, not only had not been encountered in any of the student's basal reading books, but which have relatively low

frequency of occurrence in the Carroll, Davies, and Richman (1971) corpus. List 6 words, therefore, were expected to be relatively difficult.

The list of 50 pseudo words was constructed from a longer list of pseudo words prepared by William Nagy based on his experience with earlier versions of the Anderson-Freebody testing procedure (Nagy, in press). Three types of pseudo words, pseudo derivatives, decodable distrators, and "nonwords", were used. Pseudo derivatives were constructed by attaching an inappropriate, albeit plausible, prefix or suffix to a word (e.g., earthous, stuffish, observement). Decodable distrators follow regular patterns and correspond to Venezky's level 1 words described above (e.g., blint, cobe, compure). "Nonwords" are stings of letters that follow general rules of English, but which would correspond to Venezky's levels 2 and 3 words (e.g., derceuse, flouch, sprale). The list of 100 words and pseudo words used for the test is presented in Appendix B, along with a designation of type (NW for nonword, G for Ginn, etc.). SFI's for real words, and the frequency of occurrence in the three reading series are also provided in Appendix B.

Procedure

Words for both tests were presented to students using a specially prepared personal computer program (see Appendix C for a listing of the program and Appendix D for the instructions to the test administrator). First students were introduced to the program and asked to respond to several questions about their reading instructional placement and their reading habits. After several practice items for each test, students were presented with individual words.

The instructions for the decoding speed and accuracy test were printed on the computer terminal and read by the test administrator. The words were presented on the screen one at a time and students were instructed to

read the word aloud. They were encouraged to say the words "real fast" but to say them so that they could be understood (see Appendix E for detailed instructions). Trained examiners recorded correct or incorrect responses by pressing appropriate computer keys. Accuracy and time of response were automatically recorded by the computer. If the student did not respond within 5 seconds, the computer was programmed to advance to the next word and to record an incorrect response for the skipped word. All 100 words were clustered into lists of 20 words and then randomly ordered for presentation. After each group of 20 words was presented, there was a short rest period. Testing was terminated any time there were 8 consecutive errors.

The speed and accuracy of recognition of word meaning test was also administered by the computer. For this test the student responded directly by pressing a green key if the string of letters that appeared on the screen "spell a word that you know". Students were instructed to press the red key "if the letters do not spell a word that you know" (see Appendix F for complete instructions for this test). As with the decoding speed and accuracy test, students were first given a set of practice items and there was a brief rest period after each set of 20 items. Speed of response and accuracy of response was automatically recorded by the computer program.

Analyses

The proportion correct on each item and the point-biserial correlation of the item with the total correct score on the two 100 item tests were computed. Coefficient alpha estimates of reliability were computed for each test. Scatter plots of the total accuracy scores and the total time scores were inspected and the correlations among the four total scores were computed.

Item difficulties and arcsin transformations of the difficulties were correlated with SFI, the log of the frequency of occurrence in third grade texts analyzed by Carroll, Davies, and Richman (1971), and the Venezky predictability scores. Multiple correlations of the the above word characteristic variables with the arcsin transformations of item difficulties were also computed.

Part scores corresponding to word lists described above for each test were computed for the speed and accuracy of response on each test. These part scores were intercorrelated and used as dependent variables for discriminant analyses and univariated analyses of variance with groups formed by school/basal reading series.

Finally, Mantel-Haenszel differential item performance analyses (Holland and Thayer, 1986) were performed for each pair of schools/basal reading series. The latter analytical procedure has been proposed as means of identifying items that function differentially for different groups of test takers and is currently being applied operationally with some tests by Educational Testing Service to help identify items that are unusually difficult for minority students. In the present context, the Mantel-Haenszel statistics were used to test the hypothesis that words that occur only in the reading series used at a given school would be easier for students attending that school than students with comparable overall performance who attended another school where the word did not occur in the basal reading series.

Results

Descriptive Statistics: Total Tests

The means and standard deviations for the full 100 item tests are listed in Table 3 by school and for the full sample. As can be seen, the decoding accuracy scores are relatively high while the accuracy scores on

Table 3

Means and Standard Deviations on Total Test Speed and Accuarcy Scores by School and for the Total Sample

	School A (N = 76)	School B (N = 147)	School C (N = 75)	Total (N = 298)
Decoding Accuracy				
Mean	85.3	81.9	79.1	82.1
Standard Deviation	18.8	22.5	18.6	20.7
Decoding Speed (Seconds per Word)				
Mean	1.76	1.98	1.84	1.89
Standard Deviation	.71	.82	.64	.76
Word Recognition Accuracy				
Mean	69.1	67.9	69.5	68.6
Standard Deviation	11.8	11.0	11.9	11.4
Word Recognition Speed (Seconds per Item)				
Mean	1.95	1.98	2.07	2.00
Standard Deviation	.48	.57	.58	.55

the Anderson-Freebody type of word recognition test are a good deal lower. The response times were slightly lower on the decoding test, with an overall average of 1.89 seconds per word, than on the word recognition test (mean = 2.00 seconds per item).

The school means are not significantly different for the decoding speed scores or for either of the word recognition scores. The decoding accuracy scores are significantly different ($F = 12.82$, $p < .01$). The mean decoding accuracy score for school A is significantly higher than that for schools B or C, but the latter two means do not differ significantly.

The decoding accuracy scores have very high internal consistency (coefficient alpha = .98). The accuracy scores for the word recognition test have a lower, but still relatively high coefficient alpha of .87.

Item difficulties and point-biserial correlations are listed in Appendices A and B for each word under the column headings p and rpb, respectively. As would be expected from the high internal consistency, the point-biserials are very high for the decoding test. Indeed, the median point-biserial correlation is .61 for the 100 decoding items. Several items of the recognition test, on the other hand, have unacceptably low point-biserial correlations with the total correct scores. The median point-biserial correlation is .27 for the 100 word recognition items. However, 34 of the items have point-biserials of .35 or higher. This suggests that the internal consistency of the recogniton test could be enhanced by replacing some of the test items. The five most problematic words on the recognition test all were drawn from outside any of the three basal reading series, were words that occurred no more than 3 times in the grade three texts analyzed by Carroll, Davies, and Richman (1971), and had SFI's of 41.1 or less.

Relation of Word Characteristics to Student Performance

The median SFI and median item difficulty for each of the ten decoding speed and accuracy word lists are presented in Table 4. As was expected, the words in list 1, which occurred in all three reading series at both grades 1 and 2 and which had high SFIs were extremely easy. List 2 words, which occurred in all series but only at grade 2 and had SFIs close to 60, were also answered correctly by the vast majority of the students.

Although the median SFIs for words in 3, 4, 5, and 9 are only slightly lower than those in list 2, the proportion correct scores are between .05 and .10 lower. As expected, lists 6, 7, 8, and 10, which have lower SFIs are the most difficult lists. Among the 6 lists with words that are found in one and only one of the basal series, lists 3 and 6, the two unique to Ginn are more difficult than their matched counterparts from the other two series or, for that matter, than their matched counterparts drawn from outside any of the three series.

To investigate the relationship of word characteristics to student performance at a more detailed level, the an arcsin transformation was first applied to the item difficulties. The transformed item difficulties for the 100 decoding test items and the 50 real words on the recognition test were then correlated with the following word charcteristics: (1) SFI, (2) the log of the frequency of occurrence of the word in grade 3 texts analyzed by Carroll, Davies, Richman (1971), and (3) decodability level.

For both tests, the SFI provided the best prediction of the transformed item difficulties and the other characteristics did not signficantly improve the prediction. The correlation between the SFI of a word and the arcsin transformantion of the difficulty for the 100 words on

Table 4

Median SFI and Median Item Difficulty for the Ten Decoding Test Lists

List	Description	Median SFI	Median Difficulty
1	All Series Grades 1 and 2	69.7	.965
2	All Series Grade 2 only	60.9	.940
3	Unique to Ginn, high SFI	57.2	.840
4	Unique to HBJ, high SFI	59.5	.885
5	Unique to HM, high SFI	57.1	.890
9	Outside Series, high SFI	58.6	.850
6	Unique to Ginn, low SFI	51.4	.720
7	Unique to HBJ, low SFI	49.0	.830
8	Unique to HM, low SFI	51.7	.795
10	Outside Series, low SFI	51.0	.765

the decoding test was .64. The corresponding correlation for the 50 real words on the recognition test was .71. Thus, frequency of occurrence is highly related both to the likelihood that the word will pronounced correctly and the likelihood that the word will be recognized.

Total and Part Score Intercorrelations

The intercorrelations among the four total speed and accuracy scores are reported in Table 5 by school and for the total sample. As can be seen, the correlation between the two accuarcy scores is .71 or higher for the students in each of the three schools and for the total sample. Although the total sample correlation of .72 is substantial, each of the tests has unique reliable variance. When corrected for attenuation using the alpha coefficients for the two tests, the correlation is .78.

Since the speed scores are measured in average seconds for a response, the negative correlations between speed and accuarcy are expected. However, the magnitude of the negative correlation between speed and accuracy on the decoding test (-.93 for the total sample) is higher than expected. This high correlation suggests that a separate measure of decoding speed may add little if any new information to that available from the accuracy score. For the word recognition test the negative correlation between speed and accuracy is less extreme (-.25 for the total sample). The correlations between the speed scores on the two tests are positive as expected, but relatively low (.32 for the total sample). The accuracy scores on the decoding test have small negative correlations with the recognition speed scores, however, there is a strong negative correlation (-.74 for the total sample) between the accuracy score on the recognition test and the speed score on the decoding test.

Table 5

Total Score Intercorrelations by School and for the Total Sample

Varable	Group	Decoding Accuracy	Recognition Accuracy	Decoding Speed	Recognition Speed
Decoding Accuracy	School A	1.00	.73	-.96	-.01
	School B	1.00	.71	-.95	-.16
	School C	1.00	.79	-.91	-.47
	Total	1.00	.72	-.93	-.21
Recog. Accuracy	School A	.73	1.00	-.71	.16
	School B	.71	1.00	-.76	-.31
	School C	.79	1.00	-.78	-.50
	Total	.72	1.00	-.74	-.25
Decoding Speed	School A	-.96	-.71	1.00	.10
	School B	-.95	-.76	1.00	.28
	School C	-.91	-.78	1.00	.61
	Total	-.93	-.74	1.00	.32
Recog.	School A	-.01	.16	.10	1.00
	School B	-.16	-.31	.28	1.00
	School C	-.47	-.50	.61	1.00
	Total	-.21	-.25	.32	1.00

The correlations among the part scores for the decoding test are reported in Table 6. To conserve space, the ten lists of words were collapsed into 5 distinct sets to compute the speed and accuracy part scores. Lists 1 and 2 were combined to yield a part score based on the 20 words found in all three series. Lists 3 and 6 were combined to form a part score based on the 20 words unique to Ginn. In a similar fashion HBJ, HM, and General part scores were computed by combining lists 4 and 7, 5 and 8, and 9 and 10, respectively. The variables are denoted by the labels All, Ginn, HBJ, HM, and Gen followed by the letter A for accuracy scores and the letter S for speed scores.

The correlations among the five accuracy part scores are all .75 or higher and the four lowest correlations all involve the first part score which consists of the 20 words that appear in all three series. Since these words are considerably less difficult than those that make up the other four part scores, the lower correlations involving the "All" part score are probably attributable to this difference in difficulty. The correlations among the remaining four part scores range from a low of .89 to a high of .92. These are exceptionally high correlations for tests made up of only 20 items each.

Except for correlations involving the 20 words unique to the Houghton-Mifflin series, all of the correlations among speed scores are also quite high, ranging from a low of .87 to a high of .97 and the correlations of speed with accuracy scores are also substantial, albeit negative. The correlations involving the Houghton Mifflin speed scores, however, are all very low. The speed of response to the words unique to the Houghton-Mifflin series was essentially unrelated to the speed of response to any of the other four subsets of words for students in schools using the other two

Table 6

Total Sample Intercorrelations for the Decoding Test Part Scores

Variable	All-A	Ginn-A	HBJ-A	HM-A	Gen-A	All-S	Ginn-S	HBJ-S	HM-S	Gen-S
All-A	1.00	.75	.81	.79	.76	-.82	-.72	-.78	-.07	-.72
Ginn-A	.75	1.00	.89	.92	.92	-.81	-.89	-.89	-.12	-.88
HBJ-A	.81	.89	1.00	.91	.90	-.84	-.85	-.91	-.10	-.87
HM-A	.79	.92	.91	1.00	.92	-.85	-.90	-.91	-.13	-.89
Gen-A	.76	.92	.90	.92	1.00	-.83	-.89	-.91	-.13	-.92
All-S	-.82	-.81	-.84	-.85	-.83	1.00	.88	.90	.18	.87
Ginn-S	-.72	-.89	-.85	-.90	-.89	.88	1.00	.96	.21	.97
HBJ-S	-.78	-.89	-.91	-.91	-.91	.90	.96	1.00	.19	.96
HM-S	-.07	-.12	-.10	-.13	-.13	.18	.21	.19	1.00	.19
Gen-S	-.72	-.88	-.87	-.89	-.92	.87	.97	.96	.96	1.00

basal series (correlations of .11 to .12 in school A and of -.04 to .00 in school B). On the other hand, for students in school C, where the Houghton-Miffilin series is used, the correlations of the HM speed scores with the other four speed scores were considerably higher (.57 with the All-S, .61 with Ginn-S, .59 with the HBJ-S, and .57 with the Gen-S).

Discriminant Analyses and Univariate ANOVAs

The 10 part scores from the decoding test and a total of 16 part scores from the word recognition test were used as dependent variables in two separated discriminant analyses to test the hypothesis that exposure to words in the basal reading series would affect student performance. The students were classified by school for these analyses. Univariate analyses of variance were also performed on each of the part scores.

For the decoding test there were two significant discriminant functions. The first function had a cannoical correlation with group membership of .486 and an associated F-ratio of 5.83, which with 20 and 572 degrees of freedom is significant at the .001 level. The second function had a cannoical correlation of .312 with an F-ratio of 3.44 ($p < .01$). The standardized cannonical weights for the two functions are listed in Table 7. Also shown in Table 7 are the univariate F-ratios and school means for each variable.

The Ginn and General speed and accuracy scores all have large positive weights on the first function and the HM accuracy score has a large negative weight. The first discriminant function most clearly separates school C form the other two schools. School C has a mean on this weigthed composite defined by the first function of -.92 while schools A and B have means of -.01 and .47, respectively. The negative mean for school C is consistent with the negative weight for the HM accuracy score and the

Table 7

Standardized Cannonical Weights, Univariate F-ratios, and Variable Means by School

Variable	Cannoical Weights Fn. 1	Fn. 2	Univariate F-Ratio	Means School A	School B	School C
All-A	-.42	.27	.79	19.2	18.8	18.8
Ginn-A	1.49	.56	3.53*	16.1	15.1	14.0
HBJ-A	.89	-1.62	1.10	16.6	16.7	15.8
HM-A	-1.32	.34	1.51	16.6	15.5	15.6
Gen-A	1.52	1.34	2.77	16.7	15.8	14.8
All-S	-.13	-.07	1.16	1.31	1.41	1.36
Ginn-S	1.35	-2.47	3.25*	1.89	2.19	2.01
HBJ-S	-.53	.94	.84	1.85	2.00	1.93
HM-S	-.32	-.19	1.47	1.93	2.01	2.09
Gen-S	1.53	2.16	1.54	1.92	2.10	1.96

* Significant at the .05 level.

expectation that students would have a relative advantage on words that are unique to a series used at a given school.

The pattern of weights on the second function does not follow as simple of a pattern. The postive end of the second function is defined primarily by the General speed and accuracy scores while the negative end of the function is defined by a combination of the HBJ accuracy and the Ginn speed scores. The second function separates school A from schools B and C. The school means on the weighted composite defined by the second function are .56, -.19 and -.19 for schools A, B, and C, respectively.

From an inspection of the univariate F-ratios and the part score means, it can be seen that only the Ginn accuracy and speed scores show significant differences between schools. The direction of the means is consistent with the hypothesis that students from school A where the Ginn series is used would have a relative advantage on the words that are unique to that series. However, school A students also score higher on the accuracy scores on all but the words that are unique to HBJ, though none of the latter differences are statistically significant.

There is a tendency for students from school B to perform relatively better on the words unique to HBJ, the basal series used at school B, while the students from school C have their best relative performance on the words unique to the series used at their school (HM). The apparent effects, while consistent with the hypothesis, are, at best, weak and not statistically significant in the latter two cases.

Sixteen part scores, eight speed and eight accuracy scores were used in the discriminant analysis for the word recognition test. These scores were defined by the three types of pseudo words, the words unique to each series, those found in all three series and those drawn from outside any of the three. The discriminant analysis for the 16 part scores formed from

the word recognition test yielded no significant differencs between schools. Hence, the part score means and univariate analyses are not presented.

Mantel-Haenszel Analyses

The Mantel-Haenszel procedure (see Holland & Thayer, 1986) provides a chi-square test with one degree of freedom of the null hypothesis that there is no relationship between group membership and performance on the item after controlling for overall performance on the test. As applied here, groups were defined by school and the total score on the 60 publisher unique items was used as the control for school differences. In this way a two-by-two table is constructed for each total score on the 60 items. The pair of schools being compared defines the rows of the table and the score on the item (right or wrong) defines the columns of the table. The chi-square is then based on a weighted average of all the two-by-two tables across the score levels. Thus, a significant chi-square indicates that, after controlling for total score, students in the two schools being compared have a different probability of correctly pronouncing the word in question.

The direction of the difference is indexed by two statistics: the common odds ratio and the group difference in item delta after adjusting for group differences in total score. A common odds ratio of 1 indicates that, after controlling for total score, there is no differential performance on the item for students from the two schools being compared. A value of 2 would indicate that students in school 1 are twice a likely to answer the item correctly as their matched counterparts in school 2 while a value of .5 would indicate just the opposite. The delta difference is a transformation of the common odds ratio that expressed the difference in

group performance on item difficulty scale used by Educational Testing Service. The delta scale has a mean of 13 and a standard deviation of 4. A difference of 1 or larger is considered large enough to be of practical significance in differential item funcitoning analyses conducted on ETS testing programs.

The results of the Mantel-Haenszel analyses are summarized in Table 8. The first section of the table reports the words that are unique to the Ginn series that had significant chi-squares for each of the comparisons involving school A where that series is used. The substantive hypothesis was that students from school A would do better on those words than students from either schools B and C where the other two series are used. If this hypothesis is correct, the chi-square should be significant, the odds ratio should be greater than 1 and the delta difference should be greater than zero.

As can be seen, three of the twenty words unique to the Ginn series had significant chi-square values in the comparisons of schools A and B. The common odds ratios and delta differencs are all in the hypothesized direction. The average delta difference for all twenty words unique to the Ginn series for the comparison of schools A and B was also positive (.77), though, as indicated, only three of the differences were statistically significant.

For the comparison of schools A and C with the words unique to the Ginn series, four words showed significant differences. However, the difference was in the hypothesized direction on only three of the four words. The fourth word, "alley", favored students from school C, as is indicated by an odds ratio that is less than 1 and a negative delta

Table 8

Results of the Mantel-Haenszel Analyses

Words Unique to the Ginn Series

Comparison of Schools A and B				Comparison of Schools A and C			
Word	Chi-Square	Odds Ratio	Delta Difference	Word	Chi-Square	Odds Ratio	Delta Difference
solid	8.67	3.7	3.1	science	7.01	4.0	3.3
saucer	6.89	3.7	3.1	burrow	5.93	3.6	2.8
acorns	5.32	3.8	3.2	alley	4.33	.17	-4.2
				acorns	4.41	3.6	3.2

Words Unique to Harcourt Brace Jovanovich

Comparison of Schools B and A				Comparison of Schools B and C			
Word	Chi-Square	Odds Ratio	Delta Difference	Word	Chi-Square	Odds Ratio	Delta Difference
glider	7.83	2.8	2.4	glider	14.30	4.5	3.5
medal	7.22	4.3	3.4	pencil	7.74	5.0	3.8
fiction	7.11	3.7	3.0				
dolphin	4.22	6.5	4.4				

Words Unique to Houghton Mifflin

Comparison of Schools C and A				Comparison of Schools C and B			
Word	Chi-Square	Odds Ratio	Delta Difference	Word	Chi-Square	Odds Ratio	Delta Difference
no significant differences				aunt	8.65	.22	-3.6
				useful	7.78	.15	-4.5
				count	4.83	4.0	3.3
				grove	4.35	2.9	2.5

difference. The mean of the delta differences for all twenty Ginn words for the comparison of schools A and C was .77.

The results for the twenty words that are unique to the Harcourt-Brace-Jovanovich series are shown in the middle section of Table 8. By focusing on school B where this series is used, odds ratios greater than 1 and positive delta differences are again consistent with the hypothesized exposure effect in comparisons with schools A and C. Four HBJ words had significant chi-squares in the comparison of schools B and A and two words had significant chi-squares in the comparisons of schools B and C. The common odds ratios and delta differences associated with these significant chi-squares are in the hypothesized direction in all six cases. For all twenty HBJ words the mean delta difference was .47 for the school B vs. A comparison and .22 in the school B vs. C comparison.

The bottom section of Table 8 reports the results for the twenty Houghton Mifflin words. There are no significant differences in the comparison of schools C and A. Although there are significant differences for four of the words in the comparison of schools C and B the differences are consistent with the hypothesized exposure effect in only two cases and are in the opposite direction in the other two cases. For all twenty HM words the mean delta difference was .31 for the school C vs. A comparison and .73 for the school C vs. B comparison.

Discussion

The results presented above indicate that there is a strong relationship between word frequency as measured by the Carroll, Davies, and Richman (1971) SFI index and the difficulty of the word. This is true both for the decoding speed and accuracy test and the test of word recognition. The evidence that exposure to specific words in the basal reading series

has an important impact on the test performance of students by the beginning of third grade is more equivocal.

There is evidence from the discriminant analysis, the univariate anovas, and the Mantel-Haenszel analyses that students using the Ginn series have a relative advantage on words unique to that series. The Mantel-Haenszel analyses also provide evidence that students using the HBJ series have a relative advantage on words unique to that series. Support for the hypotheses that students from school C would have a relative advantage on words from the HM series is weaker, however. The variable weights and school means on the first discriminant function are consistent with the hypothesis, but the Mantel-Haenszel results are inconsistent with the hypothesis for school C for two of the four words with significant chi-squares.

A variety of factors may contribute to the lack of stronger support for the exposure effect hypothesis. Basals are, of course, only a part of the material that a student reads. The nature and extent of outside reading could be a much more important factor than the specific basal vocabulary. Since students vary considerably in the number of books that they have completed in a series it is also possible that these differences dilute the effects. Both of these possibilities will be explored in future analyses using data that are being collected as part of the longitudinal study on outside reading and data that have already been collected as part of the present study on reading books completed at the time of the data collection last fall.

The internal consistency reliability of the word recognition test is comparable to that obtained for many published vocabulary tests and the internal consistency of the decoding speed and accuracy test is considerably higher than that reported for most commericially available

decoding tests. It remains to be seen, however, whether these two tests will have expected relationships to other measures of word knowledge and measures of reading comprehension. The latter issues will be addressed in the second phase of this project.

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Appendix A

Decoding Speed and Accuracy Test

No.	Word	Type	G	D	SFI	3rd	HBJ	HM	Ginn	p	rpb
1.	children	all	1	2	66.7	865	40	23	32	.95	.55
			2				13	38	43		
2.	them	all	1	2	73.6	2401	117	110	100	.96	.32
			2				28	38	20		
3.	never	all	1	1	67.5	525	35	41	41	.96	.58
			2				12	11	10		
4.	soon	all	1	1	65.9	471	39	16	29	.98	.41
			2				21	14	15		
5.	about	all	1	2	73.8	2168	104	62	91	.97	.50
			2				15	40	49		
6.	water	all	1	2	70.8	1791	52	36	90	.97	.47
			2				19	19	25		
7.	call	all	1	1	63.9	639	49	61	55	.98	.32
			2				41	30	42		
8.	many	all	1	3	73.5	2702	94	52	46	.93	.29
			2				42	26	28		
9.	made	all	1	1	71.2	1315	75	35	50	.96	.54
			2				31	28	14		
10.	new	all	1	3	70.0	1115	47	30	47	.99	.30
			2				23	26	48		
11.	luck	all	2	1	55.0	46	10	6	5	.95	.42
12.	catch	all	2	1	60.8	234	4	5	7	.93	.49
13.	quiet	all	2	2	59.6	136	9	7	13	.87	.63
14	spot	all	2	1	58.6	86	4	8	7	.89	.53
15.	uncle	all	2	2	55.1	50	5	9	26	.92	.69
16.	idea	all	2	3	63.9	171	34	20	4	.92	.67
17.	nothing	all	2	2	64.0	235	5	26	20	.95	.65
18.	deep	all	2	1	62.6	178	10	4	18	.97	.39
19.	above	all	2	3	66.4	286	7	4	5	.95	.67
20.	horse	all	2	2	63.2	303	21	18	5	.98	.40
21.	clothes	HBJ	2	3	60.2	178	8	-	-	.84	.60
22.	choose	HM	2	2	61.0	122	-	6	-	.88	.57
23.	thread	G	2	2	55.7	70	-	-	11	.84	.70
24.	weight	Gen	-	2	60.1	56	-	-	-	.81	.70
25.	fruit	HM	2	3	58.2	98	-	7	-	.93	.63
26.	saved	HBJ	2	1	55.5	59	6	-	-	.96	.53
27.	loose	G	2	2	56.0	28	-	-	12	.58	.33
28.	shore	Gen	-	2	58.9	71	-	-	-	.89	.46
29.	shot	HBJ	2	1	58.0	45	8	-	-	.75	.31
30.	sight	HM	2	2	60.1	88	-	8	-	.85	.64
31.	wire	G	2	1	59.0	102	-	-	5	.71	.56
32	rule	Gen	-	1	60.0	55	-	-	-	.93	.62
33.	plate	Gen	-	1	57.1	53	-	-	-	.85	.50
34.	count	HM	2	2	58.6	120	-	15	-	.89	.66
35.	knife	G	2	2	57.4	24	-	-	18	.93	.75
36.	swam	HBJ	2	1	54.4	45	10	-	-	.57	.23

Appendix A (continued)

No.	Word	Type	G	D	SFI	3rd	HBJ	HM	Ginn	p	rpb
37.	handle	Gen	-	1	57.1	51	-	-	-	.92	.64
38.	dollar	HBJ	2	2	55.4	64	30	-	-	.95	.56
39.	coffee	G	2	1	57.1	28	-	-	27	.95	.62
40.	useful	HM	2	1	58.8	40	-	14	-	.90	.57
41.	science	G	2	3	60.0	41	-	-	7	.84	.66
42.	trouble	HM	2	2	60.9	102	-	7	-	.92	.68
43.	captain	Gen	-	3	57.7	54	-	-	-	.85	.57
44.	twenty	HBJ	2	1	58.3	55	5	-	-	.92	.74
45.	middle	G	2	1	61.1	144	-	-	13	.89	.67
46.	rubber	HM	2	1	57.6	46	-	12	-	.89	.66
47.	narrow	Gen	-	2	58.8	58	-	-	-	.87	.75
48.	collect	HBJ	2	2	55.0	30	20	-	-	.81	.74
49.	hardly	Gen	-	1	58.5	93	-	-	-	.84	.70
50.	solid	G	2	2	58.2	54	-	-	5	.51	.50
51.	garage	HM	2	3	53.3	87	-	5	-	.54	.55
52.	office	HBJ	2	2	59.1	51	5	-	-	.92	.68
53.	prove	Gen	-	3	56.5	29	-	-	-	.75	.58
54.	track	G	2	1	57.5	36	-	-	5	.94	.73
55.	whose	HM	2	3	61.6	50	-	6	-	.68	.43
56.	score	HBJ	2	2	57.2	87	5	-	-	.86	.61
57.	minute	HM	2	3	60.7	123	-	9	-	.88	.71
58.	liquid	G	2	2	57.9	41	-	-	9	.84	.71
59.	island	Gen	-	3	60.1	106	-	-	-	.76	.61
60.	pencil	HBJ	2	1	56.9	74	9	-	-	.94	.75
61.	manage	Gen	-	2	51.3	6	-	-	-	.71	.66
62.	titles	HBJ	2	2	51.4	17	7	-	-	.78	.59
63.	aboard	G	2	2	54.0	15	-	-	6	.85	.71
64.	bottle	HM	2	1	52.8	29	-	5	-	.91	.75
65.	dessert	HM	2	3	48.6	10	-	6	-	.44	.37
66.	tender	Gen	-	1	51.5	9	-	-	-	.88	.65
67.	burrow	G	2	2	48.4	18	-	-	9	.49	.46
68.	glider	HBJ	2	2	47.2	6	9	-	-	.60	.48
69.	behave	Gen	-	1	52.3	12	-	-	-	.60	.55
70.	turnip	HM	2	2	48.7	29	-	17	-	.80	.64
71.	beaver	G	2	2	51.9	26	-	-	20	.71	.56
72.	princess	HBJ	2	1	52.4	55	19	-	-	.83	.68
73.	alley	G	2	2	47.4	20	-	-	5	.66	.62
74.	dolphin	HBJ	2	1	45.2	6	5	-	-	.83	.72
75.	private	HM	2	2	54.1	10	-	5	-	.71	.56
76.	wander	Gen	-	2	50.2	15	-	-	-	.71	.58
77.	acorns	G	2	1	46.0	12	-	-	11	.62	.59
78.	panic	HM	2	1	47.5	2	-	11	-	.58	.50
79.	apron	Gen	-	2	50.8	21	-	-	-	.49	.50
80.	medal	HBJ	2	2	45.9	6	9	-	-	.74	.59
81.	invite	G	2	1	51.6	12	-	-	7	.73	.58
82.	carpet	Gen	-	1	49.4	9	-	-	-	.82	.66
83.	report	HBJ	2	1	49.6	11	5	-	-	.90	.79
84.	awful	HM	2	2	51.5	19	-	5	-	.79	.66

Appendix A (continued)

No.	Word	Type	G	D	SFI	3rd	HBJ	HM	Ginn	p	rpb
85.	fork	G	2	2	51.9	18	-	-	11	.90	.76
86.	fort	HBJ	2	2	53.9	25	17	-	-	.86	.70
87.	aunt	HM	2	3	52.0	20	-	21	-	.83	.70
88.	wrap	Gen	-	1	50.5	19	-	-	-	.82	.70
89.	grove	HM	2	1	47.6	7	-	5	-	.74	.54
90.	wreck	Gen	-	1	50.5	6	-	-	-	.66	.57
91.	snail	HBJ	2	2	48.3	2	5	-	-	.90	.75
92.	worse	G	2	2	54.8	26	-	-	5	.75	.61
93.	blossom	Gen	-	2	47.4	9	-	-	-	.80	.70
94.	saucer	G	2	2	48.9	11	-	-	16	.63	.61
95.	fiction	HBJ	2	1	49.6	2	10	-	-	.67	.64
96.	strangers	HM	2	2	51.4	18	-	7	-	.83	.68
97.	stuff	HM	2	1	52.8	13	-	7	-	.88	.74
98.	sneeze	HBJ	2	1	46.8	9	7	-	-	.88	.72
99.	fetch	G	2	1	49.2	10	-	-	9	.75	.63
100.	switch	Gen	-	1	52.2	23	-	-	-	.86	.71

Type: All = word in all three basal series
G = word unique to Ginn
HBJ = word unique to Harcourt-Brace-Jovanovich
HM = word unique to Houghton-Mifflin
Gen = word not fourn in any of the three basal series

G: Grade for basal series frequencies

D: Decodability index

SFI: Standard Frequency Index from Carroll, Davies, & Richman (1971)

3rd: Frequency of occurance in the grade 3 texts analyzed by Carroll, et al.

HBJ: Frequency in Harcourt-Brace-Jovanovich series (grade 2 unless two row are listed for a word, then the first row gives frequency in grade 1)

HM: Frequency in Houghton-Mifflin series (grade 2 unless two row are listed for a word, then the first row gives frequency in grade 1)

Ginn: Frequency in Ginn series (grade 2 unless two row are listed for a word, then the first row gives frequency in grade 1)

p: Propotion correct (item difficulty)

rpb: Point-biserial correlatio of item with total correct score.

Appendix B

Word Recognition Test

No.	Word	Type	SFI	3rd	HBJ	HM	Ginn	p	rpb
1.	lemicle	NW						.91	.26
2.	cousin	G	52.1	12	-	-	4	.75	.37
3.	tambist	NW						.87	.42
4.	above	All	66.4	286	7	4	5	.98	.18
5.	sandwich	G	49.9	15	-	-	4	.94	.36
6.	weast	DD						.55	.38
7.	dessert	HM	46.6	10	-	6	-	.84	.30
8.	strauch	NW						.82	.35
9.	luck	All	55.0	46	10	6	5	.96	.26
10.	derceuse	NW						.87	.36
11.	palace	HM	53.8	58	-	4	-	.68	.25
12.	flouch	NW						.78	.37
13.	narrow	Gen	58.8	58	-	1	-	.89	.37
14.	eager	HM	54.2	19	-	4	-	.57	.21
15.	sprale	NW						.80	.34
16.	blint	DD						.66	.18
17.	mudge	DD						.77	.14
18.	aboard	G	54.0	15	-	-	6	.93	.28
19.	earthous	PD						.80	.41
20.	children	Al	66.7	865	40	23	32	.97	.21
21.	wrinkled	HM	49.5	11	-	4	-	.74	.38
22.	cobe	DD						.54	.36
23.	monument	G	46.8	5	-	-	4	.52	.01
24.	shouting	HBJ	52.8	23	4	-	-	.94	.26
25.	darkdom	PD						.72	.39
26.	explore	G	54.7	15	-	-	4	.83	.45
27.	werpet	NW						.85	.50
28.	grove	HM	47.6	7	-	5	-	.83	.23
29.	tritholent	NW						.96	.31
30.	carpet	Gen	49.4	9	-	-	-	.91	.25
31.	stumbled	HM	48.6	6	-	6	-	.63	.27
32.	compure	DD						.53	.38
33.	switch	Gen	52.2	23	-	-	-	.91	.36
34.	shore	Gen	58.9	71	1	-	-	.96	.15
35.	trained	HBJ	54.8	23	4	-	-	.70	.49
36.	breat	DD						.61	.46
37.	ganaceous	NW						.87	.33
38.	snail	HBJ	48.3	25	5	-	-	.96	.28
39.	handle	Gen	57.1	51	-	1	-	.91	.26
40.	catch	All	60.8	234	4	5	7	.96	.16
41.	stuffish	PD						.68	.47
42.	nerist	DD						.66	.31
43.	fortune	HBJ	51.9	12	4	-	-	.67	.24
44.	idea	All	63.9	171	34	20	4	.93	.21
45.	liquid	G	57.9	41	-	-	9	.89	.38
46.	spaunt	NW						.82	.43

Appendix B (continued)

No.	Word	Type	SFI	3rd	HBJ	HM	Ginn	p	rpb
47.	purdary	NW						.80	.35
48.	tender	Gen	51.5	9	-	-	-	.88	.34
49.	fruit	HM	58.2	98	-	-	-	.95	.20
50.	eraser	HBJ	45.5	12	-	4	-	.74	.38
51.	unfolding	Gen	38.9	1	-	-	-	.79	.38
52.	dispicture	PD						.64	.33
53.	daneral	PD						.82	.30
54.	unclehood	PD						.60	.16
55.	distract	Gen	35.6	0	-	-	-	.65	.18
56.	ralotene	NW						.87	.42
57.	conversal	PD						.65	.21
58.	dangle	Gen	38.5	0	-	-	-	.64	.22
59.	shrink	Gen	43.5	0	-	-	-	.86	.21
60.	bome	DD						.59	.33
61.	diverted	Gen	39.2	0	-	-	-	.21	-.23
62.	weatherous	PD						.76	.30
63.	developmental	Gen	38.4	0	-	-	-	.35	.18
64.	mude	DD						.76	.41
65.	mirene	DD						.79	.22
66.	ackler	NW						.76	.39
67.	eternally	Gen	38.7	0	-	-	-	.30	.13
68.	legendary	Gen	45.0	1	-	-	-	.34	-.03
69.	sorgen	NW						.73	.35
70.	jumble	Gen	41.6	2	-	-	-	.71	.05
71.	pennant	Gen	41.1	3	-	-	-	.43	-.12
72.	burnage	PD						.67	.28
73.	quiz	Gen	41.1	5	-	-	-	.81	.32
74.	sculpturous	PD						.68	-.02
75.	environmental	Gen	42.8	4	-	-	-	.30	.07
76.	propellage	PD						.67	.27
77.	giraves	DD						.66	.23
78.	porfame	PD						.51	.14
79.	shellac	Gen	39.9	2	-	-	-	.20	-.26
80.	reminding	Gen	42.2	1	-	-	-	.70	.26
81.	pless	DD						.61	.55
82.	robbit	DD						.61	.46
83.	windshield	Gen	44.6	5	-	-	-	.62	.41
84.	steepth	PD						.72	.35
85.	nomadic	Gen	40.5	0	-	-	-	.13	-.15
86.	bristle	Gen	31.3	0	-	-	-	.59	.14
87.	snoopness	PD						.53	.22
88.	musicsome	PD						.73	.30
89.	jolt	Gen	39.5	0	-	-	-	.51	-.03
90.	observement	PD						.48	-.27
91.	bloodible	PD						.63	.28
92.	fancied	Gen	40.2	0	-	-	-	.34	-.10
93.	hingement	NW						.69	.30
94.	rectangles	Gen	43.2	2	-	-	-	.50	.23
95.	strounted	NW						.72	.25

Appendix B (continued)

No.	Word	Type	SFI	3rd	HBJ	HM	Ginn	p	rpb
96.	bonely	PD						.49	.21
97.	creng	NW						.73	.38
98.	sculptures	Gen	36.3	2	-	-	-	.53	.34
99.	thowed	DD						.54	.33
100.	ritter	DD						.56	.28

Type: NW = nonword
PD = pseudo derivative
DD = decodable distrator
All = word in all three basal series
G = word unique to Ginn
HBJ = word unique to Harcourt-Brace-Jovanovich
HM = word unique to Houghton-Mifflin
Gen = word not found in any of the three basal series

SFI: Standard Frequency Index from Carroll, Davies, & Richman (1971)

3rd: Frequency of occurance in the grade 3 texts analyzed by Carroll, et al.

HBJ: Frequency in Harcourt-Brace-Jovanovich basal series grades K, 1, and 2.

HM: Frequencey in Houghton-Mifflin basal series grades K, 1, and 2.

Ginn: Frequency in Ginn basal series grades K, 1, and 2.

p: Proportion correct (item difficulty).

rpb: Point-biserial correlation of item with total correct score.

Appendix C

Test Administration Program

```
3 DIM FR(10),PT(10)
4 DIM X(100),Q$(10),K$(100)
5 DIM A$(100),D(100),S(100),W$(100),P$(10)
10 DATA "dog","find","like","on","happy","to","you","sat","something","go"
11 DATA "children","them","never","soon","about","water","call","many","made","n
ew"
12 DATA "luck","catch","quiet","spot","uncle","idea","nothing","deep","above"
,"horse"
13 DATA "clothes","choose","thread","weight","fruit","saved","loose","shore","sh
ot","sight"
14 DATA "wire","rule","plate","count","knife","swam","handle","dollar","coffee",
"useful"
15 DATA "science","trouble","captain","twenty","middle","rubber","narrow","colle
ct","hardly","solid"
16 DATA "garage","office","prove","track","whose","score","minute","liquid","isl
and","pencil"
17 DATA "manage","titles","aboard","bottle","dessert","tender","burrow","glider"
,"behave","turnip"
18 DATA "beaver","princess","alley","dolphin","private","wander","acorns","panic
","apron","medal"
19 DATA "invite","carpet","report","awful","fork","fort","aunt","wrap","grove","
wreck"
20 DATA "snail","worse","blossom","saucer","fiction","strangers","stuff","sneeze
","fetch","switch"
21 DATA "school","ragment","house","car","foiting","snolage","reading","large","
agiered","time"
22 DATA "c","z","c","c","z","z","c","c","z","c"
23 DATA "lemicle","cousin","tambist","above","sandwich","weast","dessert","strau
ch","luck","derceuse"
24 DATA "palace","flouch","narrow","eager","sprale","blint","mudge","aboard","ea
rthous","children"
25 DATA "wrinkled","cobe","monument","shouting","darkdom","explore","werpet","gr
ove","tritholent","carpet"
26 DATA "stumbled","compure","switch","shore","trained","breat","ganaceous","sna
il","handle","catch"
27 DATA "stuffish","nerist","fortune","idea","liquid","spaunt","purdary","tender
","fruit","eraser"
28 DATA "unfolding","dispicture","daneral","unclehood","distract","ralotene","co
nversal","dangle","shrink","bome"
29 DATA "diverted","weatherous","developmental","mude","mirene","ackler","eterna
lly","legendary","sorgen","jumble"
30 DATA "pennant","burnage","quiz","sculpturous","environmental","propellage","g
iraves","porfame","shellac","reminding"
31 DATA "pless","robbit","windshield","steepth","nomadic","bristle","snoopness",
"musicsome","jolt","observement"
32 DATA "bloocible","fancied","hingement","rectangles","strounted","bonel","cre
ng","sculpturss","thowed","ritter"
```

```
35 CT=0
36 CX=0
40 INPUT "ID = ";ID
45 INPUT "First name ";N$
48 INPUT "Last name ";Z$
49 GOTO 4000
50 CLS
55 FOR I=1 TO 5
56 PRINT
57 NEXT I
60 PRINT "Hello ";N$;".  It is nice to meet you."
65 PRINT
70 FOR I=1 TO 1500
71 NEXT I
75 PRINT "I'm a computer.  I can print words,"
80 PRINT
85 PRINT "but I can't talk."
89 PRINT
90 PRINT
91 FOR I=1 TO 2000
92 NEXT I
95 PRINT "Will you say the words for me?"
98 C$=INKEY$
99 IF C$="" THEN 98
100 CLS
105 FOR I=1 TO 5
110 PRINT
115 NEXT I
120 PRINT "Thank you, ";N$;"."
125 PRINT
130 FOR I=1 TO 1000
131 NEXT I
135 PRINT "When I show you a word, I want"
140 PRINT
145 PRINT "you to say it real clearly so
150 PRINT
155 PRINT "I can understand it.  OK?"
160 D$=INKEY$
161 IF D$="" THEN 160
165 CLS
170 FOR I=1 TO 5
175 PRINT
176 NEXT I
180 PRINT "I'm real fast.  So, I want you"
185 PRINT
190 PRINT "to say the words real fast."
195 FOR I=1 TO 2000
200 NEXT I
205 PRINT
210 PRINT
```

```
215 PRINT "Remember to say the words so I
216 PRINT
220 PRINT "can understand them.  But say them
225 PRINT
230 PRINT "fast.  OK?"
235 E$=INKEY$
236 IF E$="" THEN 235
240 GOSUB 5000
245 PRINT "Sometimes I might move on to the next"
247 PRINT
248 PRINT "word before you have had a chance to"
249 PRINT
250 PRINT "say the last word."
251 PRINT
252 PRINT "Don't worry if that happens.  Just say"
253 PRINT
254 PRINT "the next word I show you.  OK, ";N$;"?"
255 V$=""
256 V$=INKEY$
257 IF V$="" THEN 256
258 GOSUB 5000
260 PRINT "Good.  Are you ready to start
265 PRINT
270 PRINT "now, ";N$;"?"
275 F$=INKEY$
280 IF F$="" THEN 275
290 CLS
315 FOR I=1 TO 10
320 READ P$(I)
325 NEXT I
330 K=1
331 KK=5
335 FOR I=K TO KK
336 CLS
337 FOR M=1 TO 800
340 NEXT M
345 FOR J=1 TO 12
350 PRINT
355 NEXT J
360 PRINT TAB(15) P$(I)
365 G$=INKEY$
370 IF G$="" THEN 365
372 IF G$="r" THEN G=G+1
375 NEXT I
380 IF KK=10 THEN 400
385 IF G>3 THEN 400
390 K=6
392 KK=10
395 GOTO 335
400 CLS
```

```
401 H$=INKEY$
402 IF H$="" THEN 401
405 FOR I=1 TO 100
410 READ W$(I)
415 NEXT I
420 FOR K=1 TO 5
421 CT=CT+1
425 FOR J=1 TO 20
427 I=(K-1)*20+J
430 CLS
431 FOR M=1 TO 800
432 NEXT M
435 FOR L=1 TO 12
440 PRINT
445 NEXT L
450 PRINT TAB(15) W$(I)
455 X(I)=TIMER
460 C=TIMER
465 CC=C-X(I)
470 IF CC>5 THEN 490
475 A$(I)=INKEY$
480 IF A$(I)="" THEN 460
481 IF A$(I)=" " THEN 483
482 GOTO 487
483 A$(I)=""
484 A$(I)=INKEY$
485 IF A$(I)="" THEN 484
486 GOTO 430
487 GOTO 510
490 D(I)=5
495 A$(I)="t"
500 NC=NC+1
505 GOTO 520
510 Y=TIMER
515 D(I)=Y-X(I)
520 S(I)=0
525 IF A$(I)="r" THEN S(I)=1
530 IF S(I)=0 THEN NS=NS+1
535 IF S(I)=1 THEN NS=0
540 IF D(I)<5 THEN NC=0
545 IF NC=12 THEN 1000
550 IF NS=12 THEN 1000
560 NEXT J
562 IF K=5 THEN 800
565 CLS
570 FOR L=1 TO 5
575 PRINT
580 NEXT L
585 PRINT "That was good, "IN$;"."
```

```
590 PRINT
595 FOR L=1 TO 1000
596 NEXT L
635 GOSUB 6000
680 NEXT K
685 GOTO 800
700 CLS
705 FOR I=1 TO 5
710 PRINT
715 NEXT I
720 PRINT "Thanks, ";N$;"."
725 PRINT
730 PRINT "You were a big help."
735 PRINT
740 PRINT "Maybe you can help me again
745 PRINT
750 PRINT "some time."
755 PRINT
760 PRINT
765 FOR M=1 TO 2600
770 NEXT M
771 GOSUB 6000
772 FOR M=1 TO 5
773 PRINT
774 NEXT M
775 PRINT "Goodbye, ";N$;"."
780 FOR M=1 TO 2600
785 NEXT M
790 CLS
795 END
800 OPEN "b:results" FOR APPEND AS #1
805 WRITE #1,ID,N$,Z$
806 WRITE #1,RB,T1,T2,KR
810 FOR I=1 TO 100
815 WRITE #1,I,D(I),A$(I),S(I)
820 T=T+S(I)
825 TT=TT+D(I)
830 NEXT I
835 WRITE #1,TT,T
840 CLOSE #1
850 GOTO 1800
1000 IF I=100 THEN 1040
1005 IG=I+1
1010 FOR II=IG TO 100
1020 A$(II)="t"
1025 D(II)=5
1030 S(II)=0
1035 NEXT II
1040 GOTO 800
```

```
1800 FOR I=1 TO 10
1805 P$(I)=""
1810 NEXT I
1815 FOR I=1 TO 100
1820 S(I)=0
1825 W$(I)=""
1830 X(I)=0
1832 A$(I)=""
1835 D(I)=0
1845 NEXT I
1850 NC=0
2000 CLS
2001 CX=1
2005 FOR I=1 TO 4
2010 PRINT
2012 NEXT I
2015 PRINT "Thank you.  You were a big help."
2016 FOR M=1 TO 1500
2017 NEXT M
2018 GOSUB 6000
2019 PRINT
2020 PRINT
2025 PRINT "I have a problem that"
2030 PRINT
2035 PRINT "I think you could help"
2040 PRINT
2050 PRINT "me solve."
2055 PRINT
2056 PRINT
2060 FOR M=1 TO 2500
2065 NEXT M
2070 PRINT "If you would like to help me,"
2071 PRINT
2072 PRINT "touch the key with a green dot."
2075 Y$=INKEY$
2080 IF Y$="" THEN 2075
2085 CLS
2090 FOR I=1 TO 4
2095 PRINT
2100 NEXT I
2105 PRINT "Good.  Here is my problem."
2110 PRINT
2111 PRINT
2115 FOR I=1 TO 1000
2120 NEXT I
2125 PRINT "I have a lot of groups of letters."
2130 PRINT
2135 PRINT "Some groups of letters spell words."
```

```
2140 PRINT
2145 PRINT "But some groups just look like words."
2150 PRINT
2155 PRINT "They aren't really words."
2160 PRINT
2163 PRINT "Touch the green key."
2166 Y$=""
2170 Y$=INKEY$
2171 IF Y$="" THEN 2170
2172 GOSUB 5000
2175 PRINT "My problem is that I can't tell which"
2180 PRINT
2185 PRINT "groups of letters are real words and"
2190 PRINT
2195 PRINT "which just look like words."
2200 PRINT
2205 PRINT
2210 FOR I=1 TO 4000
2215 NEXT I
2220 PRINT "Will you help me find out?"
2221 PRINT
2222 PRINT "If you will, then touch the"
2223 PRINT
2224 PRINT "green key."
2225 U$=""
2226 U$=INKEY$
2227 IF U$="" THEN 2226
2235 CLS
2240 FOR I=1 TO 4
2245 PRINT
2250 NEXT I
2255 PRINT "Good.  Here is what I want"
2260 PRINT
2265 PRINT "you to do."
2270 PRINT
2275 PRINT "When I show you a group of letters,
2280 PRINT
2285 PRINT "you should touch the green key if"
2290 PRINT
2295 PRINT "the letters spell a word that you know."
2296 FOR I=1 TO 500
2297 NEXT I
2300 PRINT
2305 PRINT "But if the letters do not spell a"
2310 PRINT
2315 PRINT "word that you know, touch the
2320 PRINT
2322 PRINT "red key."
```

```
2325 PRINT
2330 FOR I=1 TO 2500
2335 NEXT I
2340 PRINT "Touch the green key when you"
2341 PRINT
2342 PRINT "are ready."
2345 V$=INKEY$
2350 IF V$="" THEN 2345
2355 IF V$="c" THEN 2400
2360 CLS
2365 PRINT "That is not the green key."
2370 PRINT
2375 PRINT "Touch the green key."
2380 PRINT
2390 V$=""
2395 GOTO 2345
2400 CLS
2405 FOR I=1 TO 4
2410 PRINT
2415 NEXT I
2418 PRINT "Good!"
2419 PRINT
2420 PRINT "Now find the red key."
2425 PRINT
2435 PRINT
2440 FOR I=1 TO 1000
2445 NEXT I
2450 PRINT
2455 PRINT "Touch the red key."
2457 V$=""
2460 V$=INKEY$
2465 IF V$="" THEN 2460
2470 IF V$="z" THEN 2500
2475 CLS
2480 PRINT "That was not the red key."
2485 FOR I=1 TO 2500
2490 NEXT I
2495 CLS
2497 GOTO 2420
2500 CLS
2505 FOR I=1 TO 4
2510 PRINT
2515 NEXT I
2520 PRINT "Good.  Now, I will show you some groups"
2525 PRINT
2530 PRINT "of letters.  Remember to touch the"
2535 PRINT
2540 PRINT "green key if is a real word."
```

```
2545 PRINT
2548 PRINT "Touch the red key if the letters"
2550 PRINT
2555 PRINT "do NOT spell a real word."
2560 PRINT
2565 PRINT
2568 FOR I=1 TO 2000
2570 NEXT I
2575 PRINT "Touch the green key when you"
2576 PRINT
2577 PRINT "are ready."
2580 V$=""
2585 V$=INKEY$
2590 IF V$="" THEN 2585
2595 CLS
2600 FOR K=1 TO 10
2601 READ P$(K)
2602 NEXT K
2603 FOR K=1 TO 10
2604 READ Q$(K)
2605 NEXT K
2606 FOR K=1 TO 10
2607 CLS
2608 FOR M=1 TO 1000
2609 NEXT M
2610 FOR I=1 TO 12
2611 PRINT
2612 NEXT I
2613 PRINT TAB(15) P$(K)
2614 C=TIMER
2615 V$=""
2616 V$=INKEY$
2617 IF V$="" THEN 2616
2618 IF V$=Q$(K) THEN SC=SC+1
2619 IF V$=Q$(K) THEN PR(K)=1
2620 IF K>1 THEN 2640
2621 IF PR(K)=0 THEN 2629
2622 CLS
2623 PRINT "RIGHT!  school is a word,"
2625 PRINT "so you touched the green key."
2626 FOR L=1 TO 3000
2627 NEXT L
2628 GOTO 2657
2629 CLS
2630 PRINT "School is a word, so you should"
2631 PRINT
2632 PRINT "have touched the green key."
2633 FOR L=1 TO 3000
2634 NEXT L
```

```
2635 GOTO 2657
2640 IF K>2 THEN 2657
2641 IF PR(K)=0 THEN 2649
2642 CLS
2643 PRINT "RIGHT!  ragment is not a word,"
2644 PRINT
2645 PRINT "so you touched the red key."
2646 FOR L=1 TO 3000
2647 NEXT L
2648 GOTO 2657
2649 CLS
2650 PRINT "Ragment is not a word, so you"
2651 PRINT
2652 PRINT "should have touched the red key."
2653 FOR L=1 TO 3000
2654 NEXT L
2657 CC=TIMER
2658 PT(K)=CC-C
2659 NEXT K
2660 GOSUB 7000
2661 FOR I=1 TO 100
2662 READ W$(I)
2665 NEXT I
2670 FOR K=1 TO 5
2672 CT=CT+1
2675 FOR J=1 TO 20
2680 I=(K-1)*20+J
2685 CLS
2690 FOR M=1 TO 1000
2695 NEXT M
2700 FOR L=1 TO 12
2705 PRINT
2710 NEXT L
2715 PRINT TAB(15) W$(I)
2720 X(I)=TIMER
2725 C=TIMER
2730 CC=C-X(I)
2735 IF CC>5 THEN 2760
2740 A$(I)=INKEY$
2745 IF A$(I)="" THEN 2725
2746 IF A$(I)=" " THEN 2748
2747 GOTO 2752
2748 A$(I)=""
2749 A$(I)=INKEY$
2750 IF A$(I)="" THEN 2749
2751 GOTO 2685
2752 GOTO 2790
2760 D(I)=5
```

```
2765 A$(I)="t"
2770 NC=NC+1
2775 GOTO 2800
2790 Y=TIMER
2795 D(I)=Y-X(I)
2800 NEXT J
2801 IF K=5 THEN 3000
2805 CLS
2810 FOR M=1 TO 4
2815 PRINT
2820 NEXT M
2825 PRINT "Good work, ";N$
2830 PRINT
2835 PRINT "You are a big help."
2840 PRINT
2845 FOR M=1 TO 1000
2850 NEXT M
2851 GOSUB 6000
2890 NEXT K
3000 OPEN "b:results" FOR APPEND AS #1
3001 WRITE #1,ID,N$,Z$,SC
3002 FOR K=1 TO 10
3003 WRITE #1,PR(K),PT(K)
3004 NEXT K
3005 FOR I=1 TO 100
3010 WRITE #1,I,D(I),A$(I)
3015 NEXT I
3020 CLOSE #1
3025 GOTO 700
4000 CLS
4005 FOR M=1 TO 4
4010 PRINT
4015 NEXT M
4020 PRINT "What is the name of your "
4025 PRINT
4030 PRINT "reading book?"
4035 PRINT
4040 INPUT "code number = ";RB
4050 GOSUB 5000
4055 PRINT "How much time do you spend reading?"
4060 PRINT
4065 PRINT "when you are NOT in school?"
4070 PRINT
4075 PRINT "1. A lot of time."
4080 PRINT
4081 PRINT "2. A little time."
4082 PRINT
4085 PRINT "3. No time at all."
```

```
4090 PRINT
4095 INPUT "Number of choice = ";T1
4100 GOSUB 5000
4105 IF T1=3 THEN 4170
4110 PRINT "How much time is that for you?"
4115 PRINT
4120 PRINT "1. Almost every day."
4125 PRINT
4130 PRINT "2. About 3 or 4 times a week."
4135 PRINT
4140 PRINT "3. About 1 or 2 times a week."
4145 PRINT
4150 PRINT "4. Less than once a week."
4155 PRINT
4160 INPUT "Number of choice = ";T2
4165 GOSUB 5000
4170 PRINT "What kind of a reader do you"
4175 PRINT
4180 PRINT "think your are?"
4185 PRINT
4190 PRINT "1. I'm not as good a reader as most"
4195 PRINT "   kids in my grade."
4200 PRINT
4205 PRINT "2. I read as well as most kids in"
4206 PRINT "   in my grade."
4210 PRINT
4215 PRINT "3. I'm a better reader than most"
4220 PRINT "   other kids in my grade."
4225 PRINT
4230 INPUT "Number of choice = ";KR
4235 GOTO 50
5000 CLS
5005 FOR M=1 TO 4
5010 PRINT
5015 NEXT M
5020 RETURN
6000 CLS
6005 IF CT>1 THEN 6030
6010 FOR L=1 TO 20
6015 PRINT TAB(L) N$;" ";Z$
6020 NEXT L
6025 GOTO 6500
6030 IF CT>2 THEN 6055
6035 FOR L=1 TO 20
6040 PRINT N$ TAB(14) N$ TAB(28) N$
6045 NEXT L
6050 GOTO 6500
6055 IF CT>3 THEN 6100
```

```
6060 FOR L=1 TO 10
6065 PRINT TAB(L) N$;" ";Z$
6070 NEXT L
6075 FOR L=1 TO 10
6080 LL=11-L
6085 PRINT TAB(LL) N$;" ";Z$
6090 NEXT L
6095 GOTO 6500
6100 IF CT>4 THEN 6140
6105 FOR L=1 TO 10
6110 PRINT TAB(L) N$
6120 LL=L+11
6125 PRINT TAB(LL) Z$
6130 NEXT L
6135 GOTO 6500
6140 CT=0
6145 FOR L=1 TO 9
6150 LL=29-L
6155 PRINT TAB(L) N$ TAB(LL) Z$
6160 NEXT L
6165 FOR L=1 TO 9
6170 LI=10-L
6175 LL=29-LI
6180 PRINT TAB(LI) N$ TAB(LL) Z$
6185 NEXT L
6470 IF V$="z" THEN 2500
6500 PRINT
6501 IF CX=1 THEN 6531
6502 IF K<5 THEN 6506
6503 FOR L=1 TO 2500
6504 NEXT L
6505 GOTO 6560
6506 PRINT "Tell me when you are ready to"
6507 PRINT "read some more words for me."
6515 J$=""
6520 J$=INKEY$
6525 IF J$="" THEN 6520
6528 CLS
6530 GOTO 6560
6531 IF K<5 THEN 6535
6532 FOR L=1 TO 2500
6533 NEXT L
6534 GOTO 6560
6535 PRINT "Touch the green key when you"
6536 PRINT "are ready to do some more."
6545 J$=""
6550 J$=INKEY$
6555 IF J$="" THEN 6550
```

```
6556 IF J$="k" THEN 8000
6560 CLS
6565 RETURN
7000 CLS
7005 FOR M=1 TO 5
7010 PRINT
7015 NEXT M
7020 PRINT "Good, you have the idea,"
7025 PRINT
7030 PRINT "idea, ";N$;"."
7035 PRINT
7040 PRINT
7045 FOR I=1 TO 500
7050 NEXT I
7055 PRINT "Now touch the green key to"
7060 PRINT
7065 PRINT "start."
7070 V$=""
7075 V$=INKEY$
7080 IF V$="" THEN 7075
7085 RETURN
8000 IP=I+1
8005 FOR IQ=IP TO 100
8010 D(IQ)=0
8015 A$(IQ)="s"
8018 NEXT IQ
8020 GOTO 3000
```

Appendix D

Instructions to Test Administrator

1. Load DOS and enter date and time.
2. Type basic and remove DOS diskette.
3. Type width 40 and press enter.
4. Put word program diskette in drive A and blank formatted disk for data in drive B.
5. Load word from drive A. (function key 3 a:word)
6. Type run and press return.
7. When asked for ID, first name, and last name, type the requested information and press enter.
8. Read questions to student and type the number followed by the return key for each of the background questions.
9. Read all test instructions to student as they appear on the screen. When the student is asked a question press the r key (no need to press return key for remainder of student's session.)
10. Either 5 or 10 practice words will be presented. Press the r key when the student pronounces the word correctly. Press any other key for an incorrect pronunciation.
11. After the practice words have been presented, the screen will remain blank. This pause allows time for you to be sure the student is ready to start the test. When ready to start, press the r key.
12. After each set of 20 words, the student will be given a short rest and the computer will print the student's name in some pattern. The screen will then ask if the student is ready to try some more words. Press the r key when ready to continue.
13. At the end of the fifth block of 20 words, the data from the test will be

recorded on the diskette in drive B. The light should go on for drive B. The computer will then start the instructions for the second test.

14. The second test will have the student respond directly by pressing either the green key (normally the c key with a green dot on it) or the red key (normally the z key). The green key will be used to indicate that the student knows the word shown and the red key to indicate that the letters do not spell a word that the student knows. Encourage the student to place the index finger of their left hand over the red key (for no) and the index finger of their right hand over the green key (for yes).
15. Read all instructions shown on the screen, but let the student press the key (only the green key or the red key).
16. The first two practice items will provide feedback to the student. Then where will be 8 more practice items followed by a pause. During the pause remind the student to use their right hand to press the green key for words they know and their left hand to press the red key for letters that do not spell a word that they know.
17. As before, there will be a pause for a rest after each set of 20 words. The student presses the green key to continue.
18. After the fifth set of words the data will be recorded on the diskette in drive B. The session will then end by telling the student goodby.
19. When ready to start the test for another student go to step 6 i.e., type run and press return.
20. A new data diskette should be placed in drive B after every 30 students.

Emergency: If it is necessary to stop in the middle of a session, press the control key (Ctrl) and the break key (upper right hand corner of key board) at

the same time. To restart go to step 6 (i.e., type run and press return).

Pause: In case you need to pause because the child is distracted or you need to say something to the child, you can strike the space bar. This will work in either section of the test. When the space bar is touched the screen will remain unchanged until you strike the space bar (or any other key) to continue. When you strike the space bar a second time the word just presented will be presented again and the test will continue from there.

Stop testing: If it is apparent that the task is too frustrating for the child or the child is not attempting to respond by touching the red and green keys in an appropriate manner, you can stop the second test section after any of the sets of twenty real and pseudo words. To stop the test you need to touch the k key when one of the patterns of the child's name is shown on the screen with the instruction to the child to touch the green key when he or she is ready to try some more.

By touching the k at one of these points the computer will record the data collected up to that point and go to the end of the session.

Appendix E

Instructions to Student: Decoding Speed and Accuracy Test

Screen 1.

Hello Bob. It is nice to meet you.

I'm a computer. I can print words,

but I can't talk.

Will you say the words for me?

Screen 2.

Thank you, Bob.

When I show you a word, I want

you to say it real clearly so

I can understand it. OK?

Screen 3.

I'm real fast. So, I want you

to say the words real fast.

Remember to say the words so I

can understand them. But say them

fast. OK?

Screen 4.

Sometimes I might move on to the next

word before you have had a chance to

say the last word.

Don't worry if that happens. Just say

the next word I show your. OK, Bob?

Screen 5.

Good. Are your ready to start

now, Bob?

Screen 6 (presented after each set of 20 words).

That was good, Bob.

Screen 7 (The child's name is presented to fill the screen if various patterns during the puase between sets of 20 words).

Screen 8.

Tell me when you are ready to

read some more words for me.

Screen 9.

Thank you. You were a big help.

Screen 10 (After the fifth set of words the program moves to the first screen of the word recognition speed and accuracy test).

Appendix F

Word Recognition Speed and Accuracy Test

Screen 1.

I have a problem that
I think you could help
me solve.

If you would like to help me
touch the key with a green dot.

Screen 2.

Good. Here is my problem.
I have a lot of groups of letters.
Some groups of letters spell words.
But some groups just look like words.
They aren't really words.

Touch the green key.

Screen 3.

My problem is that I can't tell which
groups of letters are real words and
which just look like words.

Will you help me find out
If you will, then touch the
green key.

Screen 4.

Good. Here is what I want
you to do.

When I show you a group of letters,
you should touch the green key if
the letters spell a word that you know.

But if the letters do not spell a
word that you know, touch the
red key.
Touch the green key when you
ready.

Screen 5.

Good
Now find the red key.

Touch the red key.

Screen 6.

Good. Now, I will show you some groups
of letters. Remember to touch the
green key if it is a real word.

Touch the red key if the letters
do NOT spell a real word.

Touch the green key when you
are ready.

Screen 7 (The first practice trial is presented and feedback is provided depending on the child's response).

(if right)

RIGHT! school is a word,
so you touched the green key.

(if wrong)

School is a word, so you should
have touched the green key.

Screen 8 (the second practice item is a nonword and feedback is provided depending on the child's response).

(if right)

RIGHT! ragment is not a word
so you touched the red key.

(if wrong)

Ragment is not a word, so you
should have touched the red key.

Screen 9 (eight more practice items are presented)

Screen 10 (following each set of 20 items of the actual test, a pause parallel to the one used with the decoding speed and accuracy test occurs)

Screen 11.

Thanks, Bob.
You were a big help.
Maybe you can help me again
some time.